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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/409,644	10/01/1999	NATHAN S. LEWIS	CIT1250-2	5684
20985	7590	09/29/2003	EXAMINER	
FISH & RICHARDSON, PC 4350 LA JOLLA VILLAGE DRIVE SUITE 500 SAN DIEGO, CA 92122			SODERQUIST, ARLEN	
ART UNIT		PAPER NUMBER		
1743				

DATE MAILED: 09/29/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/409,644	LEWIS ET AL.	
	Examiner	Art Unit	
	Arlen Soderquist	1743	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) Responsive to communication(s) filed on 05 September 2003 .

2a) This action is **FINAL**. 2b) This action is non-final.

3) Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4) Claim(s) 50-72,85-90,98-110,112-123 and 126-159 is/are pending in the application.

4a) Of the above claim(s) 50-72 and 85-90 is/are withdrawn from consideration.

5) Claim(s) _____ is/are allowed.

6) Claim(s) 98-110,112-123 and 126-159 is/are rejected.

7) Claim(s) _____ is/are objected to.

8) Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9) The specification is objected to by the Examiner.

10) The drawing(s) filed on _____ is/are: a) accepted or b) objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) The proposed drawing correction filed on _____ is: a) approved b) disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) All b) Some * c) None of:

1. Certified copies of the priority documents have been received.

2. Certified copies of the priority documents have been received in Application No. _____ .

3. Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) The translation of the foreign language provisional application has been received.

15) Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) Notice of References Cited (PTO-892)

2) Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .

4) Interview Summary (PTO-413) Paper No(s) _____ .

5) Notice of Informal Patent Application (PTO-152)

6) Other: _____ .

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

2. Claims 98-110, 112-123 and 126-159 are rejected under 35 U.S.C. 103(as a) as a being unpatentable over Gibson in view of Barisci (Trends in Polymer Science, 1996, newly applied) and Casella, Thackeray, Yamato, Naarmann, Li (Materials Research Society Symposium Proceedings, 1995), Sakaguchi, Stetter (US 5,512,882, newly applied) or Wampler and Breheret, Mifsud (both US 5,801,297 and WO 95/08113), Moy or Persaud (WO 86/01599). In the patent application Gibson teaches an odor sensor. A personnel recognition sensor comprises a multiplicity of differentially responding chemo-resistor elements, each element comprising as a nonconductive substrate, as a plurality of electrodes disposed on the substrate and one or more layers of as a conductive polymer overlaying the electrodes, the conductive polymers of at least two of the elements being different; as a detector responsive to signals provided by the multiplicity of elements and arranged to provide an output signal characteristic of the multiplicity of signals; the elements being disposed in as a housing having an inlet arranged so that as a gaseous sample passing into or through the inlet contacts all of the elements in use. Page 12 teaches as a material having two different monomers used to form as a copolymer which examiner is treating as a within the scope of two different conducting materials. Page 13 shows several different polymeric materials that are usable in the invention along with ionic dopants for

incorporation into the conducting films. In the paragraph which these components are taught Gibson also teaches that copolymers and blends of the polymers listed can be used as a the polymer. Pages 14-15 teach the materials used as a sensing materials in the sensor of figure 1. Gibson does not teach the extent of the compositions in which the two conductive materials are mixed together to form as a single sensing material having the compositionally different conductive material within the conductive organic material or as a sensing array having sensors that are not organic polymer based.

In the paper Barisci gives a review of conducting polymer sensors. The review examines recent advances in the application of electrically conducting polymers in sensing devices. Methods of signal generation, mainly electrical and electrochemical, are discussed, as are strategies for introducing into the polymer structure appropriate analyte recognition characteristics. The use of conducting polymers in gas sensors and in solution sensors for detection of chemical and biochemical species was reviewed with some conclusions. Relative to the methods of signal generation, the polymers can produce signal through potentiometric, current-measuring and conductometric/resistometric methods. The current-measuring methods are taught as including 3 or 4 ways that an analyte can interact with the conductive polymer (e.g. polypyrroles, polythiophenes and polyanilines) to modify the current flow as a function of the applied potential. Relevant to the instant invention is the fact that the current measuring section points to the conductometric/resistometric section as one way that the current flow can be modified through interaction of an analyte and the conducting polymer. Further it is clear from the discussion of both sections that the current flow can be affected by the interaction of the analyte with the polymer or its counter ion. Thus there is a connection between the different signal generation methods that would have been recognized by one of skill in the art. In the gas sensor section of the paper both electronic interactions with the polymer and swelling of the polymer by the analyte are discussed as the basis for the measurable changes in the current flow in the polymers. In the first paragraph of page 311, a discussion of composite materials in which the conducting polymer is combined with another material. These composite materials showed improved reproducibility when used as sensors. The third and fourth paragraphs of the same page discuss the versatility of these conducting polymers and the fact that the molecular structure

of these materials influences their electrical properties and enables their interaction with a wide variety of chemical species for applicant ions in solution and vapor phase sensing.

In the paper Casella discusses copper dispersed into polyaniline films as a an amperometric sensor in alkaline solutions of amino acids and polyhydric compounds. As a chemically modified electrode composed of copper microparticles dispersed into as a polyaniline (PANI) film was studied as a an amperometric sensor of scantly electroactive compounds possessing -OH and -NH₂ groups. Glassy carbon was used as an electrode material and modified firstly by a PANI film, then allowed to stand in contact with a solution of copper ions, and finally, the electroreduction was done at -0.3V. Page 220 in the sentence which bridges the two columns teaches that about 12% of the deposited copper was dispersed (able to penetrate) in the polymer matrix. The electrochemical behavior of the resulting modified electrode in alkaline medium was examined by cyclic voltammetry and flow-injection amperometry. Using some representative compounds, the effect of copper loading and pH on the electrode response was studied. Constant-potential amperometric detection was applied in conjunction with anion-exchange chromatography (AEC) separations of amino acids and carbohydrates. At an applied potential of 0.55 V vs. Ag/AgCl, the detection limits (S/N = 3) for all analytes studied ranged 5-15 pmol, and the linear dynamic range was three-four orders of magnitude above the detection limits. The resulting modified electrode was found to retain 95% of its initial response in flowing streams for 3 hours of operating time. From the title at least it is clear that the copper particles are dispersed **into** the polyaniline films.

In the paper de Lacy Costello teaches composite organic-inorganic semiconductor sensors for the quantitative detection of target organic vapors. Composites of tin dioxide (an n-type semiconductor) and derivative of the conducting polymer polypyrrole (a p-type semiconductor) gave reversible changes in electrical resistance at room temperature when exposed to a range of organic vapors. The optimum amount of polymer giving highest sensitivity was found to be 2.5% by mass for the polypyrrole chloride-tin dioxide composite. Composites containing 2.5% polymer by mass, but differing in polymer derivative were fabricated and exposed to low concentrations of ethanol, methanol, acetone, methyl acetate and ethyl acetate. All gave significant and reversible decreases in electrical resistance. Direct comparison with sensors constructed solely of tin dioxide or polypyrrole at room temperature

showed the composites to be more sensitive. The gas sensitivity of the composite materials depended on the type of polymer derivative incorporated and the dopant anion associated with the polymer. The composites were simple to fabricate and gave differing response profiles to a range of organic vapors.

In the paper Thackeray teaches chemically responsive microelectrochemical devices based on platinized poly(3-methylthiophene) and shows variation in conductivity with variation in hydrogen, oxygen, or pH in aqueous solution. Microelectrochemical transistors can be prepared by connecting 2 closely spaced (~1.2 μm) Au microelectrodes (0.1 μm thick \times 2.4 μm wide \times 50 μm long) with anodically grown poly(3-methylthiophene). The amount of poly(3-methylthiophene) used involves about 10^{-7} - 10^{-6} mol of monomer/cm². Poly(3-methylthiophene) can be platinized by electrochemical reduction of PtCl_4^{2-} at the pair of coated electrodes. The change in conductivity of poly(3-methylthiophene) with change in redox potential is the basis for amplification of electrical or chemical signals; the conductivity varies by 5-6 orders of magnitude upon change in potential from +0.2 (insulating) to +0.7 (conducting) V vs. SCE in aqueous electrolyte. The Pt equilibrates poly(3-methylthiophene) with the $\text{O}_2/\text{H}_2\text{O}$ or $\text{H}_2\text{O}/\text{H}_2$ redox couples. [Poly(3-methylthiophene)/Pt]-based transistors are shown to be viable room-temperature sensors for O_2 and H_2 in aqueous solution. The O_2 reproducibly turns on the device, with 1 atmosphere of $\text{O}_2/0.1$ M $\text{HClO}_4/\text{H}_2\text{O}$ showing 0.7-mA I_D at a $V_D = 0.2$ V; H_2 reproducibly turns off the device, with 1 atmosphere of $\text{H}_2/0.1$ M $\text{HClO}_4/\text{H}_2\text{O}$ showing less than 20-nA I_D at a $V_D = 0.2$ V, where V_D (drain potential) is the applied potential between the 2 Au microelectrodes and I_D (drain current) is the current that passes between the 2 microelectrodes. The turn on with O_2 is complete within 2 minutes, and the turn off with H_2 is complete within 0.3 minutes. A platinized microelectrode of a dimension similar to the microelectrochemical transistor shows only 1.0-nA reduction current upon exposure to 1 atmosphere of O_2 ; the current amplification of the transistor is thus a factor greater than 10^5 . The transistor device can also reproducibly respond to pH changes in the pH range of 0-12, when there is a constant O_2 concentration; there is a reproducible change in I_D to alternate flow of a pH 5.5/pH 6.5 stream for over 10 h. The device responds to an injection of 10^{-6} L of 0.1 M HClO_4 into an effluent stream of 0.1 M NaClO_4 (flowing at 2 mL/min) within 4s. Study of the resistance properties of [poly(3-methylthiophene)/Pt] vs potential reveals that Pt has little effect on the intrinsic conductivity of

poly(3-methylthiophene). Rather, the role of Pt is purely as a catalyst to allow equilibration of O₂ and H₂ with the polymer. The amount of Pt used is approximately 10⁻⁷ mol/cm², and microscopy shows Pt to be present as a particle of less than 0.1-μm size.

In the paper Yamato presents a new method for dispersing palladium microparticles in conducting polymer films and its application to biosensors. Composite films of polypyrrole/sulfated poly(-hydroxyethers) (PPy/S-PHE) are electrically conducting and mechanically flexible. Palladium particles were dispersed in the films by thermally decomposing bis(dibenzylideneacetone)palladium(0) complex which had been absorbed by the films from a CHCl₃ solution. This method for loading metal particles was enabled by the high affinity of the composite films for organic compounds. TEM and energy-dispersive x-ray spectrometry (EDX) analyses revealed that fine palladium particles in the nanometer range are dispersed in the PPy/S-PHE conducting films. a glucose sensor based on the detection of hydrogen peroxide was prepared by immobilizing glucose oxidase (GOD) using glutaraldehyde on a Pd/PPy/S-PHE electrode. This biosensor responded to glucose even at 400 mV vs. Ag/AgCl, which is lower than the working potential of conventional glucose sensors prepared on a platinum electrode.

In the published application Naarmann teaches manufacture and use of electrically conductive polymers of five-membered heterocyclic compounds and anions of tetrathiafulvalene derivatives. The polymers are prepared by electrochemical oxidative polymerization of 5-membered heterocyclic compound(s) in the presence of conducting salts containing anions of tetrathiafulvalene derivatives. The polymers are used as sensors or battery electrodes. Derivatives of tetrathiafulvalene were synthesized. a solution of 1 part pyrrole and 1 part NH₄ salt of 3,6-di- -sulfonyloxy-1,2,4,5-benzo-bis(11,11',12,12'-dibenzotetrathiafulvalene) in 100 parts MeCN was electropolymerized by using Pt electrodes. The obtained polymer film had an electrical conductivity of 80 S/cm and showed a superior stability in a 1-week storage in water to a ClO₄⁻-containing polypyrrole film.

In the paper Li teaches the preparation and characterization of polyaniline-palladium composite films. Electrosynthesized polyaniline (PANI) can be chemically functionalized by incorporation of palladium clusters. The functionalization of electrochemically, freshly prepared and dried PANi film occurs spontaneously during the relaxation process. This process is carried

out in sulfuric acid containing palladium salt. The material properties of the new composite PANi-Pd film were investigated by applying electrochemical, UV-visible spectroscopic and surface microscopy techniques. The PANi-Pd composite materials behaved electrochemically different than PANi film alone or Pd film deposited electrochemically. This finding is particularly important for developing layers for chemical gas sensors, electrocatalysis or supercapacitors applications.

In the published application Sakaguchi teaches electrodes for gas sensors using electrode reaction. The electrodes consist of a composite of a resin compound, a conductive resin compound, and optionally an organic metal complex compound. Preferably, a conductive resin compound is manufactured by chemical oxidation polymerization or electrolytic polymerization. The gas sensors are useful for detection of gas components in exhaust gases and combustion waste gases, and have long life. From the attached Chemical Abstracts abstract it is clear that at least polypyrrole is disclosed as a conductive resin and cobalt phthalocyanine are disclosed. The JPO abstract teaches iron or platinum complexes with phthalocyanine and naphthalocyanine also being used.

In the patent Stetter teaches a chemical sensing apparatus for the detection of a vapor of a selected chemical substance includes a sensor whose impedance changes upon exposure to such a vapor. The sensor comprises a polymer whose physical structure is altered by the vapor, e.g., through expansion or disintegration, and electrically conductive elements that are interspersed with or separated by the polymer. The interspersed elements may consist of a fine powder of carbon or of a metal in a matrix of silicone or other vapor-sensitive polymer. The electrical contacts between the powder particles are weakened when the polymer swells or disintegrates, which results in increased resistance. Alternatively, the capacitance between two conductive layers separated by a polymer layer decreases, and hence the impedance increases, when the polymer swells upon exposure to the vapor. In the paragraph bridging columns 2-3 Stetter teaches that the particles are conductive and include carbon powder (carbon black), copper, silver, gold, platinum or other suitable metal. The patent discusses how the conductivity can be affected by either the polymer swelling or being degraded due to the interaction of the analyte with the polymer.

In the paper Wampler discusses the chemical synthesis and characterization of composites of polypyrrole and carbon black. a new class of molecular composites of carbon black and an electronically conducting polypyrrole has been synthesized by chemically polymerizing pyrrole in an aqueous dispersion of carbon black. The carbon black content of these composites can be varied from ~5% to ~85% (by weight). The surface areas and densities of these composites were compared to corresponding mixtures of carbon black and polypyrrole. The influence of carbon black on the efficiency of polymerization of pyrrole is described. The effect of carbon black content on the electronic conductivity of the composite has been mapped, and compared with the corresponding behavior of a mixture of carbon black and poly(vinyl chloride). The influence of the parent black characteristics (porosity, void vol., surface area) on the electronic conductivity of the resultant composite has been probed by comparing the behavior of composites derived from six commercial and experimental blacks. The temperature dependence of the composites has been studied as a function of the carbon black content. The application of these new materials is examined. The first page of the paper teaches that these potential application include sensors, electrocatalysis, super capacitors and fuel cells. In the sentence bridging pages 1811-1812 Wampler teaches that other similar composites of conducting polymers with polymers, metals, or metal oxides has extended the scope of their use. The paper clearly shows that the composite is superior to either component of the composite when applied to the electrocatalysis of chromium(VI) to chromium(III).

In the paper Breheret presents online differentiation of mushrooms aromas by combined headspace/multi-odor gas sensors devices. a specially designed measurement cell for direct headspace analysis, online connected to (I) a gas chromatograph equipped with an headspace injector and a sniffing-port, (ii) multisensors devices: five semiconductor gas sensors and twenty conducting polymer gas sensors, was used to discriminate nine mushrooms' aromas. The raw data of gas sensors were statistically processed, and provided pictorial presentation under sample distribution in a plan, allowing to compare the different mushrooms' aromas, with the GC/sniffing analysis. Semiconductor gas sensors succeeded in classifying four groups based on overall odor. Semiconductor gas sensors seem to be more appropriate for the mushrooms aromas discrimination than conducting polymer gas sensors. These preliminary results confirm the interest of such technologies for chemotaxonomy differentiation of wild mushrooms.

In the patent and patent application Mifsud teaches methods and devices for the detection of odorous substances and applications. a device for carrying out a method of odor detection including, in particular, a plurality of chambers, each having a plurality of semi-conductor gas sensors, conductive polymer gas sensors, surface acoustic wave gas sensors, as detection means, a variable flow gas pump for forming a gas flow in said chambers, measurement electronic device for operating the detection means, a data processing unit for recording in a file the olfactory prints obtained using the detection means, and for comparing the detected impressions with those in the file so that odors may be identified and recognized. Applications, especially to drugs, explosives, body odors and food seals.

In the paper Moy discusses transient signal modeling for fast odor classification. The Fox 2000 is an electronic nose system using an array of 6, 12, or 18 gas sensors. The anal. of sensor signals coming from a combination of metal oxide sensors and conducting polymer elements indicates the ability of predicting in only a few seconds the nature of a sample (hams, sausages, cereals...) from its olfactory fingerprint. The simulation of the signals is performed via exponential functions and applied to various foodstuffs. Online and real time Artificial Neural Network (ANN) have also been investigated for fast odor classification and recognition. Six different brands of sausages (pure pork, beef/pork sausages) have been analyzed using a 6-element array. Six samples of each type of sausage were measured 12 times and discriminant analysis was performed over the set of 72 samples using the raw data of acquisition. 94% Of the samples were correctly classified and cross validation (testing unknown samples) gave an overall success rate of 83% correctly classified samples. These results indicate the possibility to use electronic noses and pattern recognition methods for fast odor classifications.

In the published application Persaud teaches gas sensors. a sensor for gases, vapors, or odors has an organic polymeric semiconductor element which changes its electrical resistance in the presence of certain gases. The polymer is formed by electrolytic deposition on the substrate from a solution of its monomer, the solution comprising a solvent medium in which the monomer is sparingly soluble, a protic solvent, and an ionic base. a number of different gas detectors can be used to obtain from each a characteristic response to the presence of a gas, and the combination of responses can be used to distinguish between gases. The different detectors may be all based upon organic polymers, or one or more detectors may use other principles such

as flame ionization or gas chromatography. The sensor is useful in monitoring industrial environments, gas liquid chromatography, quality control in food and drinks production, and food production. Page 14, line 2-9 teach that the different types of sensors can allow the device to detect between odors that it might not otherwise be able to discriminate. Page 16, lines 15-21 teach that an alternative form of the sensor is as a polymer coated field effect transistor.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the teachings of Casella, de Lacy Costello, Thackeray, Yamato, Naarmann, Li, Sakaguchi, Stetter or Wampler relative to the incorporation of conductors such as carbon black, metal particles or metal oxide into the conductive organic polymers used in the sensing arrays of Gibson because of their sensitivity to known analyte gases or enhanced sensing and/or stability properties as taught by each of Casella, Thackeray, Yamato, Naarmann, Li, Sakaguchi or Wampler compared to sensors made with only the conductive polymers taught by Gibson and the recognized ability of conductive polymers to be affected by interactions in a number of sensing formats in a manner that changes the electronic structure and as a result the resistivity of the polymer as shown by Barisci. It would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate other types of sensors such as the metal oxide and/or surface acoustic wave devices taught by Breheret, Mifsud, Moy or Persaud into the Gibson device because of the ability to use them in combination to discriminate odors that would not easily be discriminated by a single type of sensor as taught by Breheret, Mifsud, Moy or Persaud or in the review of Barisci.

3. The declaration filed on March 4, 2003 under 37 CFR 1.131 is sufficient in view of the Harsanyi reference filed September 5, 2003 to overcome the Galal, Sestak and Torsi references.

4. Applicant's arguments with respect to the claims have been considered but are moot in view of the new ground(s) of rejection. The newly applied Barisci reference clearly shows the connection between the different signal producing methods with a date that is more than one year prior to the earliest priority for the instant application. Thus although the Sestak reference has been overcome the Barisci reference fills this aspect of the Sestak reference. The Stetter reference shows the interchangeability of carbon black and metal particles as components in a polymer sensor.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Arlen Soderquist whose telephone number is (703) 308-3989. The examiner's schedule is variable between the hours of about 5:30 AM to about 5:00 PM on Monday through Thursday and alternate Fridays.

For communication by fax to the organization where this application or proceeding is assigned, (703) 305-7719 may be used for official, unofficial or draft papers. When using this number a call to alert the examiner would be appreciated. Numbers for faxing official papers are 703-872-9310 (before finals), 703-872-9311 (after-final), 703-305-7718, 703-305-5408 and 703-305-5433. The above fax numbers will generally allow the papers to be forwarded to the examiner in a timely manner.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.



September 25, 2003

ARLEN SODERQUIST
PRIMARY EXAMINER